CLAIMS

What is Claimed is:

1. A microelectronic spring structure, comprising:

a substrate;

a beam, having a base portion, a cantilevered portion extending from said base portion, and a tip portion adjoining said cantilevered portion at an end thereof opposite to said base portion, said beam secured to said substrate at said base portion; and

a protruding member mounted to said substrate, and disposed under said cantilevered portion of said beam spaced apart from said tip portion;

wherein said microelectronic spring structure is reversibly deflectable between an undeflected position wherein the protruding member does not contact said beam, and a deflected position wherein said protruding member contacts said cantilevered portion of said beam at a position spaced apart from said tip portion.

2. The microelectronic spring structure of Claim 1, further comprising a tip structure for contacting a terminal of an electronic component, said tip structure mounted to and disposed above a surface of said beam opposite to said substrate.

3. The microelectronic spring structure of Claim 2, wherein said tip structure is mounted to said tip portion of said beam.

4. The microelectronic spring structure of Claim 2, wherein said tip structure is positioned above all of said beam, relative to said substrate.

5. The microelectronic spring structure of Claim 2, wherein said tip structure comprises a stand-off mounted to said beam, and a contact tip mounted to said stand-off..

6. The microelectronic spring structure of Claim 1, wherein said beam is mounted to said substrate and said cantilevered portion thereof extends away from said substrate.

7. The microelectronic spring structure of Claim 1, wherein said beam is connected to a first terminal of an electronic component on said substrate, and said protruding member is connected to a second terminal of the electronic component on said substrate.

8. The microelectronic spring structure of Claim 1, wherein said beam is connected to a terminal of an electronic component on said substrate, and said protruding member is not connected to any electronic component.

9. The microelectronic spring structure of Claim 1, wherein said beam and said protruding member are connected to a shared terminal of an electronic component on said substrate.

10. The microelectronic spring structure of Claim 1, wherein said beam is electrically isolated from said protruding member when said microelectronic spring structure is in the undeflected position.

11. The microelectronic spring structure of Claim 1, wherein said beam is formed by a lithographic process on a sacrificial substrate.

12. The microelectronic spring structure of Claim 1, wherein said beam is formed by lithographic process on a sacrificial layer.

13. The microelectronic spring structure of Claim 1, further comprising a post component mounted to said substrate and to said base portion of said beam, whereby said base portion of said beam is spaced apart from and secured to said substrate.

14. The microelectronic spring structure of Claim 13, wherein said post component comprises a column element, and said column element is comprised of a wire core coated with a structural material.

15. The microelectronic spring structure of Claim 13, wherein said post component comprises a group of column elements.

16. The microelectronic spring structure of Claim 15, wherein each column element of said group is comprised of a wire core coated with a structural material.

17. The microelectronic spring structure of Claim 1, wherein said beam is straight and elongate.

18. The microelectronic spring structure of Claim 1, wherein said beam is contoured.

19. The microelectronic spring structure of Claim 1, wherein said protruding member comprises a wire bonded to said substrate.

20. The microelectronic spring structure of Claim 19, wherein said protruding member further comprises a structural material coated over said wire.

21. The microelectronic spring structure of Claim 1, wherein said beam further comprises a separately extending portion, said separately extending portion extending from said base portion in a direction different from said cantilever portion.

22. The microelectronic spring structure of Claim 21, further comprising an electronic device connected to said separately extending portion of said beam and to said substrate.

23. The microelectronic spring structure of Claim 22, wherein said electronic device comprises a capacitor.

24. The microelectronic spring structure of Claim 1, wherein said protruding member comprises a substantially compressible member.

25. The microelectronic spring structure of Claim 24, wherein said protruding member comprises an elastic membrane enclosing a fluid.

26. The microelectronic spring structure of Claim 1, wherein said protruding member comprises an adjustable pressure device.

27. The microelectronic spring structure of Claim 26, wherein said protruding member comprises a rotating cam.

28. A microelectronic spring structure, comprising:

a substrate;

a beam, having a base portion, a cantilevered portion extending from said base portion, and a tip portion adjoining said cantilevered portion at an end thereof opposite to said base portion, said beam secured to said substrate at said base portion;

a post component mounted to said substrate and to said base portion of said beam, whereby said base portion of said beam is spaced apart from and secured to said substrate;

a tip structure for contacting a terminal of an electronic component, said tip structure mounted to said beam and positioned above all of said beam relative to said substrate; and

a protruding member mounted to said substrate, and disposed under said cantilevered portion of said beam;

wherein said microelectronic spring structure is reversibly deflectable between an undeflected position wherein the protruding member does not contact said beam, and a deflected position wherein said protruding member contacts said beam.

29. The microelectronic spring structure of Claim 28, wherein said beam is formed by lithographic process on a sacrificial substrate.

30. The microelectronic spring structure of Claim 28, wherein said beam is electrically isolated from said protruding member when said microelectronic spring structure is in the undeflected position.

31. The microelectronic spring structure of Claim 28, wherein said post component comprises a column element, said column element comprised of a wire core coated with a structural material.

32. The microelectronic spring structure of Claim 28, wherein said post component comprises a group of column elements.

33. The microelectronic spring structure of Claim 32, wherein each column element of said group is comprised of a wire core coated with a structural material.

34. The microelectronic spring structure of Claim 28, wherein said protruding member is spaced apart from said tip portion, whereby said protruding member contacts said cantilevered portion of said beam at a position spaced apart from said tip portion when said microelectronic spring structure is in the deflected position.

35. The microelectronic spring structure of Claim 28, wherein said beam is contoured.

36. The microelectronic spring structure of Claim 28, wherein said protruding member comprises a wire bonded to said substrate.

37. The microelectronic spring structure of Claim 36, wherein said protruding member further comprises a structural material coated over said wire.

38. The microelectronic spring structure of Claim 28, wherein said tip structure is disposed on said beam between said tip portion and said base portion spaced apart from said tip portion, and wherein said protruding member is disposed to contact said tip portion of said beam when said microelectronic spring structure is in the deflected position.

39. A microelectronic spring structure, comprising:

a substrate;

a beam, having a base portion, a cantilevered portion extending from said base portion, and a tip portion adjoining said cantilevered portion at an end thereof opposite to said base portion, said beam secured to said substrate at said base portion; wherein said beam is mounted to said substrate and said cantilevered portion thereof extends away from said substrate; and

a protruding member mounted to said substrate, and disposed under said cantilevered portion of said beam;

wherein said microelectronic spring structure is reversibly deflectable between an undeflected position wherein the protruding member does not contact said beam, and a deflected position wherein said protruding member contacts said beam.

40. The microelectronic spring structure of Claim 39, wherein said beam is electrically isolated from said protruding member when said microelectronic spring structure is in the undeflected position.

41. The microelectronic spring structure of Claim 39, wherein said beam is formed by a lithographic process.

42. The microelectronic spring structure of Claim 39, further comprising a tip structure for contacting a terminal of an electronic component, said tip structure mounted to said tip portion of said beam and positioned above all of said beam relative to said substrate.

43. The microelectronic spring structure of Claim 39, wherein said protruding member is spaced apart from said tip portion, whereby said protruding member contacts said cantilevered portion of said beam at a position spaced apart from said tip portion when said microelectronic spring structure is in the deflected position.

44. The microelectronic spring structure of Claim 39, wherein said beam is straight and elongate.

45. The microelectronic spring structure of Claim 39, wherein said beam is contoured.

46. The microelectronic spring structure of Claim 39, wherein said protruding member comprises a wire bonded to said substrate.

47. The microelectronic spring structure of Claim 46, wherein said protruding member further comprises a structural material coated over said wire.

48. A microelectronic spring structure, comprising:

a substrate;

a beam, having a base portion, a cantilevered portion extending from said base portion, and a tip portion adjoining said cantilevered portion at an end thereof opposite to said base portion, said beam secured to said substrate at said base portion; and

a protruding member connected to said beam, and disposed under said cantilevered portion of said beam;

wherein said microelectronic spring structure is reversibly deflectable between an undeflected position wherein the protruding member does not contact said substrate, and a deflected position wherein said protruding member contacts said substrate.

49. The microelectronic spring structure of Claim 48, further comprising a tip structure for contacting a terminal of an electronic component, said tip structure mounted to and disposed above a surface of said beam opposite to said substrate.

50. The microelectronic spring structure of Claim 49, wherein said tip structure is mounted to said tip portion of said beam.

51. The microelectronic spring structure of Claim 48, wherein said beam is mounted to said substrate and said cantilevered portion thereof extends away from said substrate.

52. The microelectronic spring structure of Claim 48, further comprising a post component mounted to said substrate and to said base portion of said beam, whereby said base portion of said beam is spaced apart from and secured to said substrate.

53. The microelectronic spring structure of Claim 48, wherein said beam is connected to a first terminal of an electronic component on said substrate, and said protruding member contacts a second terminal of the electronic component on said substrate, when said microelectronic spring structure is in the deflected position.

54. The microelectronic spring structure of Claim 48, wherein said beam is connected to a terminal of an electronic component on said substrate, and said protruding member does not contact any electronic component, when said protruding member is in contact with said substrate.

55. The microelectronic spring structure of Claim 48, wherein said beam and said protruding member are connected to a shared terminal of an electronic component on said substrate, when said microelectronic spring structure is in the deflected position.

56. The microelectronic spring structure of Claim 48, wherein said beam is formed by a lithographic process on a sacrificial substrate.

57. The microelectronic spring structure of Claim 48, wherein said beam is formed by a lithographic process on a sacrificial layer.

58. The microelectronic spring structure of Claim 52, wherein said post component comprises a column element, said column element comprised of a wire core coated with a structural material.

59. The microelectronic spring structure of Claim 52, wherein said post component comprises a group of column elements.

60. The microelectronic spring structure of Claim 59, wherein each column element of said group is comprised of a wire core coated with a structural material.

61. The microelectronic spring structure of Claim 48, wherein said beam is straight and elongate.

62. The microelectronic spring structure of Claim 48, wherein said beam is contoured.

63. The microelectronic spring structure of Claim 48, wherein said protruding member comprises a wire bonded to said beam.

64. The microelectronic spring structure of Claim 48, wherein said protruding member further comprises a structural material coated over said wire.

65. The microelectronic spring structure of Claim 48, wherein said protruding member is integrally formed with said beam.

66. The microelectronic spring structure of Claim 49, wherein said protruding member extends from said beam towards said tip structure and towards said substrate.

67. The microelectronic spring structure of Claim 49, wherein said protruding member is positioned to cause said tip structure to reverse wipe when said tip structure is depressed towards said substrate after said protruding member contacts said substrate.

68. A microelectronic spring structure, comprising:

a substrate;

a beam, having a base portion, a cantilevered portion extending from said base portion, and a separately extending portion extending from said base portion in a direction different from said cantilever portion, said beam secured to said substrate at said base portion;

a post component mounted to said substrate and to said base portion of said beam, whereby said base portion of said beam is spaced apart from and secured to said substrate; and

an electronic device connected to said separately extending portion of said beam and to said substrate;

wherein said microelectronic spring structure is reversibly deflectable between an undeflected position wherein said cantilevered portion of said beam is substantially free of strain, and a deflected position wherein said cantilevered portion is deflected towards said substrate under the influence of an externally applied force.

69. The microelectronic spring structure of Claim 68, wherein said beam further comprises a tip portion adjoining said cantilevered portion at an end thereof opposite to said base portion.

70. The microelectronic spring structure of Claim 69, further comprising a tip structure for contacting an electronic component, said tip structure mounted to said tip portion of said beam.

71. The microelectronic spring structure of Claim 68, wherein said electronic device comprises a capacitor.

72. The microelectronic spring structure of Claim 68, wherein said beam is formed by a lithographic process on a sacrificial substrate.

73. The microelectronic spring structure of Claim 68, wherein said post component comprises a column element, said column element comprised of a wire core coated with a structural material.

74. The microelectronic spring structure of Claim 73, wherein said post component comprises a group of column elements.

75. The microelectronic spring structure of Claim 74, wherein each column element of said group is comprised of a wire core coated with a structural material.

76. The microelectronic spring structure of Claim 68, wherein said beam is straight and elongate.

77. The microelectronic spring structure of Claim 68, wherein said beam is contoured.

78. A microelectronic spring structure, comprising:

a substrate;

a beam, having a base portion, and a cantilevered portion extending from said base portion, said beam secured to said substrate at said base portion; and

a protruding member disposed under said beam, wherein said protruding member is resilient and substantially compressible, and configured to be reversibly compressible between an equilibrium state wherein said protruding member is not compressed by any external contact force, and a compressed state wherein said protruding member is compressed between said beam and said substrate at least partially by an external contact force.

79. The microelectronic spring structure of Claim 78, wherein said beam further comprises a free end distal from said base portion, said free end being reversibly deflectable perpendicularly towards said substrate through a first elastic range, and wherein said protruding member is reversibly compressible perpendicularly towards said substrate though a second elastic range no less than half of said first elastic range.

80. The microelectronic spring structure of Claim 78, wherein said protruding member comprises an elastic membrane enclosing a fluid.

81. The microelectronic spring structure of Claim 78, wherein said protruding member comprises a mass of substantially compressible organic material.

82. The microelectronic spring structure of Claim 78, wherein said protruding member further comprises an adjustable pressure device.

83. The microelectronic spring structure of Claim 82, wherein said adjustable pressure device comprises an elastic membrane enclosing a fluid.

84. The microelectronic spring structure of Claim 82, wherein said adjustable pressure device comprises a rotating cam.

85. The microelectronic spring structure of Claim 82, wherein said adjustable pressure device comprises an actuator selected from the group comprising a piezoelectric device, a hydraulic device, a pneumatic device, a magnetic device, and an electrical device.

86. The microelectronic spring structure of Claim 78, further comprising a post component mounted to said substrate and to said base portion of said beam, whereby said base portion of said beam is spaced apart from and secured to said substrate.

87. The microelectronic spring structure of Claim 78, wherein said beam is formed by a lithographic process on a sacrificial substrate.

88. The microelectronic spring structure of Claim 78, wherein said post component comprises a column element, said column element comprised of a wire core coated with a structural material.

89. The microelectronic spring structure of Claim 86, wherein said post component comprises a group of column elements.

90. A microelectronic spring structure, comprising:

a substrate;

a beam, having a base portion, and a cantilevered portion extending from said base portion, said beam secured to said substrate at said base portion; and

a protruding member disposed under said beam; wherein said protruding member comprises an adjustable pressure device that is configured to apply an adjustable amount of pressure to said beam when said beam is in a deflected position.

91. The microelectronic spring structure of Claim 90, wherein said adjustable pressure device comprises a rotating cam.

92. The microelectronic spring structure of Claim 90, wherein said adjustable pressure device comprises an actuator selected from the group comprising a piezoelectric device, a hydraulic device, a pneumatic device, a magnetic device, and an electrical device.

93. The microelectronic spring structure of Claim 90, wherein said adjustable pressure device comprises a fluid-filled bladder.

94. The microelectronic spring structure of Claim 90, wherein said adjustable pressure device is capable of expanding to deflect said cantilevered portion of said beam away from said substrate.